



U.S. Department of Energy

## National Transportation Program



# International Transportation of Radioactive Materials



Shipments of spent fuel must follow rigorous international packaging and shipping standards.

Every year, millions of packages containing radioactive materials for use in medicine, agriculture, industry, and science are transported across international borders. Transport of these materials is carefully regulated to protect public safety and the environment.

### **Radiation Safety Standards Affecting Transportation**

The International Atomic Energy Agency (IAEA) issues standards for radiation protection, based on more than 50 years of research and experience with the transportation of radioactive materials. The agency also issues regulations that serve as a regulatory model for use in governing

the safe packaging, handling, and transport of radioactive materials in international trade. Since 1961, the IAEA has issued the advisory, *Regulations for the Safe Transport of Radioactive Material*, now known as IAEA Safety Standards Series No. ST-1. This guidance is based on the *Basic Safety Standards for Radiation Protection Against Ionizing Radiation and for the Safety of Radiation Sources*, published by the IAEA and recommendations made by the International Commission on Radiological Protection (an independent organization of physicians, radiologists, and scientists).

These standards have been extensively reviewed and agreed upon by international experts and organizations like the U.S. National Academy of Sciences and the United Nations Scientific Committee on the Effects of Atomic Radiation. More than 50 nations and organizations like the International Civil Aviation Organization and the International Maritime Organization have adopted safety requirements based on IAEA standards. The U.S. Department of Transportation (DOT) and the U.S. Nuclear Regulatory Commission (NRC) base domestic regulations on relevant portions of international safety standards.

## Radioactive Materials Transported for Production of Electricity

One of the most frequent uses of radioactive material worldwide is for the production of electricity. U.S. Nuclear Energy Institute (NEI) statistics indicate there are more than 400 nuclear power plants operating around the world (over 100 in the United States). Nuclear energy generates about 20 percent of the electricity used in the United States and about 17 percent of the world's electricity. (Source: NEI WebPage at <http://www.nei.org/>)

Natural uranium, used to manufacture fuel for these power plants, is mined around the world. Before uranium can be used as a nuclear fuel, it must be milled, processed, enriched, converted, and fabricated. The nuclear fuel is then transported to power plants worldwide.

Used, or spent, nuclear fuel is sometimes transported away from the power plant site for disposal or storage. In some countries, spent fuel is reprocessed to remove plutonium and uranium, which are then recycled and reused. The highly concentrated waste resulting from reprocessing is moved to storage or disposal sites. All of these steps involve transportation. Shipments must follow rigorous packaging and shipping standards to meet the regulations of each country whose border they cross.

Because it is highly radioactive, spent nuclear fuel poses a unique transportation challenge, and heavily shielded containers (packagings) have been developed for its transportation. Packaging designs have been tested extensively to avoid release of their contents even under severe accident conditions. DOT is the competent authority to approve foreign-certified packaging designs for transport in the

United States. NRC supports DOT through technical analysis of designs. Each country that ships radioactive material has its own regulatory structure based on IAEA standards.

## Radioactive Materials Transportation for Other Uses

Transportation of radioactive materials for use in nuclear power plants represents only a portion of international shipments. Many of the isotopes necessary for use in medicine, industry, agriculture, and scientific research are manufactured only in research and production reactors and are transported between nations.

Nearly every aspect of modern medicine involves the use of radioisotopes. They are used in the development of new prescription drugs, in AIDS and cancer research, and in diagnosing disease through such techniques as nuclear imaging. Industrial applications of radioactive materials include inspecting underground pipes for leaks and testing the thickness of paper, metal sheets, and other materials during manufacture.

Radioisotopes are also used in several common household items such as smoke detectors and some batteries. In agriculture, radioisotopes are used to trace fertilizer uptake in plants and to extend the life of some processed foods. Researchers in colleges and

universities use radioactive materials such as carbon-14 to determine the age of artifacts or to trace the origin and flow of groundwater. Much of the equipment used to explore outer space is powered by generators using radioisotopes.

## U.S. Department of Energy International Involvement

The U.S. Department of Energy (DOE) is involved in the international shipment of radioisotopes for medicine and industry, uranium metal, and spent fuel from nuclear reactors.

As part of U.S. nuclear non-proliferation initiatives, DOE recently began accepting spent nuclear fuel shipments from foreign research reactors. This spent fuel contains uranium enriched in the United States that was previously provided to foreign countries for peaceful atomic use.

As part of its commitment to safety, DOE contributes to joint international research efforts and participates in IAEA standard-setting committee activities. International cooperation continues to establish well-planned regulations that govern the safe use and transport of radioactive materials.

### Additional information on DOE's National Transportation Program may be obtained from:

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